



## UvA-DARE (Digital Academic Repository)

### Improving patient safety for the critically ill

*The challenges of implementation*

Borgert, M.

**Publication date**

2017

**Document Version**

Other version

**License**

Other

[Link to publication](#)

**Citation for published version (APA):**

Borgert, M. (2017). *Improving patient safety for the critically ill: The challenges of implementation*. [Thesis, fully internal, Universiteit van Amsterdam].

**General rights**

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

**Disclaimer/Complaints regulations**

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

# 01

GENERAL INTRODUCTION AND  
OUTLINE OF THE THESIS



## GENERAL INTRODUCTION

### Intensive care

The intensive care unit (ICU) is a highly complex environment. This complexity is due to the multitude of technologies in use, the many different medications being administered, the complexity of illnesses being treated, and the wide range of ICU professionals who work together there, often under emergency circumstances. In such complex environments, adverse events are more likely to occur. Because the tolerance of critically ill patients to such events is low, patient safety is an important issue in the ICU.<sup>1-3</sup>

### 'To err is human'

In 1999, the Institute of Medicine (IOM) released its report 'To Err is Human: Building a Safer Health System'. Since then, the issue of patient safety has become increasingly important. This report stated that around 44,000 to 98,000 patients die in hospitals in the United States every year due to preventable medical errors.<sup>4</sup> The report has had an enormous impact on awareness of patient safety issues worldwide, and has led to an increase in the number of research projects being conducted on patient safety around the world.<sup>5</sup> Patient safety research applies outcomes of safety science to achieve reliable health care delivery systems; it also minimizes the incidence and impact of, and maximizes recovery from, adverse events.<sup>6</sup> Adverse events are injuries that occur as a result of health care delivery itself rather than the underlying disease<sup>7</sup>, and are seen as a serious problem that must be prevented.

### How defining patient safety has changed over time

Only a few decades ago, complications in hospitals were seen to be an inevitable consequence of medical interventions.<sup>8</sup> This has changed over the years, and some types of complications have come to be seen as unacceptable, and as potentially preventable adverse events. For example, hospital-acquired infections (HAIs) were once seen as unavoidable complications. Due to a better understanding of the mechanisms of infectious disease transmission and of how to prevent HAIs, we now see these infections as unacceptable complications.<sup>9</sup> Over the years, even more complications have become preventable - including falls, pressure ulcers, catheter-related urinary tract infections, and venous thromboembolism - and are now seen as unacceptable events. Due to the continuous improvement of medical interventions and surgical techniques and the growing concerns for patient safety, the number of unacceptable events might be even larger in future.<sup>10</sup> Vincent and Amalberti state that patient safety can be seen as a 'constantly moving target'.<sup>10</sup> According to Vincent, patient safety is therefore defined as

‘the avoidance, prevention, and amelioration of adverse outcomes or injuries stemming from healthcare itself. It should address events that span the continuum of “errors” and “deviations” to accidents.’<sup>11</sup>

### **Learning from incidents**

To improve patient safety, it is important to understand the causes of potentially preventable adverse events. Analysing adverse events and searching for interventions to prevent them is one way to gain insight into these causes. Progress has been made on the quality of patient safety research itself as well as on incident analyses. In the earlier days of patient safety research, incidents were viewed as a substandard performance by individual professionals, and inattentiveness, distractions, and low motivation were some of the reasons given for their occurrence.<sup>10</sup> Nowadays, though, incidents are seen more as problems resulting from organizational or system-wide factors.<sup>12,13</sup> Health care professionals are influenced by the work they are doing, the team they are part of, their working environment, and the organization they work for, which are known as system factors.<sup>14</sup> The actions of professionals are influenced by processes within the broader organization or within their local working environment. A slogan coined by Paul Batalden from the Institute for Healthcare Improvement (IHI) underlines this principle: ‘Every system is perfectly designed to get the results it gets.’<sup>15</sup>

### **Quality chasm**

Many patients come to harm because professionals do not consistently follow evidence-based recommendations or guidelines.<sup>11</sup> Guidelines aim to reduce variability in clinical care and to increase adherence to evidence-based interventions.<sup>10</sup> However, studies suggest that patients receive only about 50% of the recommended care, or undergo unnecessary or harmful treatments or investigations.<sup>16,17</sup> This problem actually starts with the slow uptake and dissemination of research findings from biomedical science in hospitals. Often, multiple studies have to be conducted before new findings become official recommendations for clinical practices.<sup>18</sup> One important reason for this is the external validity, generalization and applicability of new research findings.<sup>19</sup> Often, studies do not provide sufficient contextual information, which makes it hard to make judgements about the applicability of study results. Subsequent studies have shown that implementation of these recommendations lags even further behind. This means there is a large gap between the time new research findings become available and when they are actually incorporated into daily care practices. As a consequence, the clinical care many patients receive during this gap is not in line with the latest research

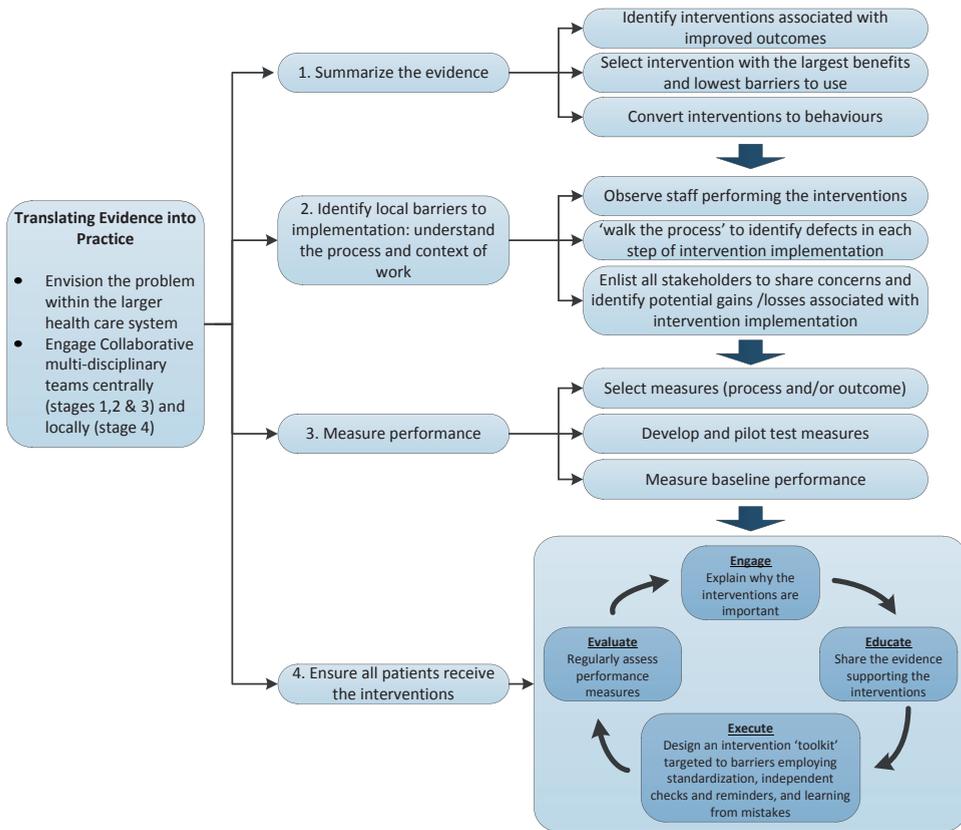
findings.<sup>18</sup> In the literature, this gap is called the 'quality chasm', and the IHI has captured it perfectly in a quote borrowed from the German poet Goethe: 'Knowing is not enough; we must apply. Willing is not enough; we must do.'<sup>20</sup>

## **Implementation of quality improvement interventions**

Even though there might be strong evidence and high-quality clinical guidelines, it is a real challenge to actually implement new findings. This is especially true if this requires changes to behaviour, clinical practices, the organization, or how professionals collaborate.<sup>17</sup> To improve patient safety and the quality of care provided to critically ill patients, we need to understand those factors that facilitate or hamper successful implementation of evidence-based practices and guidelines.<sup>21</sup> According to Cabana *et al.*, implementation can be affected by multiple barriers related to professionals' knowledge, attitudes, and behaviour.<sup>22</sup> Examples from the literature show that the professionals themselves can form a barrier to implementation: sometimes they are not aware of clinical guidelines or are not familiar with evidence-based recommendations; they do not agree with the recommendations or the evidence; they believe the guideline is too difficult to use in their own hospital or that patient-related factors may interfere; or they are not motivated to change their practices.<sup>23</sup> However, patient-related factors, organizational factors, and economic factors have also been shown to be important barriers to implementation.<sup>17,24</sup> To select strategies for successful implementation, it is important to understand the barriers and facilitators to implementation.<sup>25</sup> Implementation science has therefore become more important over the years, especially for implementing quality improvement projects in hospitals. Implementation science can be defined as 'the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice to improve the quality and effectiveness of health care'.<sup>26,27</sup>

## **Model for translating evidence into practice**

Various models, frameworks, and theories have been developed to understand and explain why implementation of quality improvement initiatives succeeds or fails.<sup>25,26</sup> Pronovost *et al.* developed a useful model for translating research findings into daily practice in the ICU.<sup>28</sup> This model sets out the phases of the process of translating research into practice; it also includes how research findings are implemented. The model, which consists of four steps, can be used to guide the process of translating research into clinical practices, and is shown in Figure 1.



**Figure 1.** Model for translating evidence into practice.<sup>28</sup>

Pronovost *et al.* used this model to improve the reliability of care for patients with central venous catheters in the ICU.<sup>28</sup> This quality improvement project aimed to reduce the number of central line infections associated with central line insertions.<sup>28</sup> During the study period of 18 months, the overall central line infection rate was reduced by 66%. Despite this success, implementing evidence-based practices in the ICU remains a challenge on the whole.<sup>17,25</sup> Patient safety improvements show varying results.<sup>25,29</sup> In most cases, new evidence-based practices are introduced rapidly, with no structured implementation plan available for changing behaviour. Successful implementation usually depends on a systematic approach that has been thoroughly planned and analysed.<sup>25</sup>

## AIM AND OUTLINE OF THIS THESIS

This thesis focuses on the implementation of strategies for improving patient safety and quality of care for critically ill patients by encouraging the uptake and implementation of best practices.

**Part I** focuses on improving patient safety for critically ill patients on nursing wards by implementing a rapid response system with support from the ICU. **Part II** focuses on improving patient safety for critically ill patients in the ICU by implementing evidence-based care bundles.

### **Part I. Improving patient safety for critically ill patients on nursing wards**

Serious adverse events such as unplanned admission to an ICU, cardiac arrest, and unexpected death are often preceded by changes in vital sign observations.<sup>30,31</sup> In this respect, they are thus predictable.<sup>30,31</sup> However, hospital staff do not always recognize these signs in time, or do not act on them in an adequate or timely fashion.<sup>32</sup> Failure to recognize or respond adequately to the deteriorating patient can lead to a delay in treatment, which can subsequently lead to serious adverse events such as cardiopulmonary resuscitation or even death.<sup>32-34</sup> Rapid response systems (RRSs) are developed to improve care for the deteriorating patient. RRSs have 'afferent' (criteria for detecting deterioration) and 'efferent' (responsive) arms.<sup>35</sup> The afferent arm is concerned with recognizing the patient's condition prior to deterioration using a 'track-and-trigger system', such as the modified early warning score (MEWS).<sup>36</sup> The efferent arm is designed to trigger response by the rapid response team (RRT).<sup>35</sup> This team generally consists of ICU physicians and ICU nurses, and is designed to respond within 10 minutes for evaluation, triage, and treatment of patients who clinically deteriorate on a nursing ward and to prevent them from suffering a serious adverse event.<sup>37</sup>

Part I consists of the following two chapters. **Chapter 2** describes the effects of different MEWS implementation strategies on nursing wards. Nursing wards were randomized to measure the MEWS either three times daily or on indication (i.e. if one or more vital signs were abnormal). In this quasi-experiment, we studied the effects of protocolized measurement (i.e. three times daily) of the MEWS versus measurement on indication. In **Chapter 3**, we retrospectively analyse the 'false arrests' to determine the 'level of urgency' of these false arrests to find scope for improving efficiency within emergency care.

## **Part II. Improving patient safety for critically ill patients in the ICU.**

The IHI developed the concept of care bundles to enhance the reliability of care and to improve the quality of care.<sup>38,39</sup> A care bundle is a structured way of improving care processes and patient outcomes. Bundles consist of a small set of three to five evidence-based interventions for clinical processes or patient populations. The strength of bundling a small set of interventions is that the evidence-based care will be applied uniformly to every eligible patient. This may result in better patient outcomes than when the interventions are implemented individually.<sup>38-41</sup>

Part II focuses on the development and implementation of evidence-based care bundles for ICU patients, and consists of the following five chapters. In **Chapter 4**, we use a systematic literature review to identify methods other than the IHI approach for supporting the development of new evidence-based care bundles for the ICU. **Chapter 5** describes enteral nutrition delivery in the ICU. To find ways of improving quality of care, it is important to identify patients at risk of malnutrition. In this study, which was conducted over a period of three years, we assessed the extent to which ICU patients received their daily enteral nutritional intake during ICU admission. This study could form the basis for developing strategies for supporting ICU staff in providing adequate enteral nutrition, thereby minimizing the risk of malnutrition. In **Chapter 6**, we determine common strategies for implementing care bundles in the ICU and assess the effects of these strategies on the quality of the implementation of these bundles. **Chapter 7** describes the implementation of a transfusion care bundle for the delivery of red blood cells (RBC). In this implementation study, which had a quasi-experimental comparative study design, we investigated the difference in the effect on transfusion bundle compliance between monthly team-level audit and feedback (A&F) versus monthly team-level A&F plus timely individual A&F. In **Chapter 8** we quantify the true effect of the transfusion bundle by assessing, per transfusion, whether the decision to transfuse was based on a lower pre-transfusion haemoglobin (Hb) level than the patient's individual preset Hb threshold. The objective of this study was to investigate whether the application of the transfusion bundle would reduce the number of inappropriate RBC transfusions in an ICU setting. The final two chapters include the general discussion and summaries in both English and Dutch (**Chapters 9 and 10**).

## REFERENCES

1. Vincent JL, Abraham E, Kochanek P, Moore FA, Fink MP. *Textbook of Critical Care*. 6<sup>th</sup> edition, Saunders; 2011.
2. Dodek PM, Raboud J. Explicit approach to rounds in an ICU improves communication and satisfaction of providers. *Intensive Care Med*. 2003;29:1584-8.
3. Stockwell DC, Slonim AD. Quality and safety in the intensive care unit. *J Intensive Care Med*. 2006;21:199-210.
4. Kohn LT, Corrigan JM, Donaldson MS (Institute of Medicine). *To err is human: building a safer health system*. Washington, DC: National Academy Press; 2000.
5. Stelfox HT, Palmisani S, Scurlock C, Orav EJ, Bates DW. The 'To Err is Human' report and the patient safety literature. *Qual Saf Health Care*. 2006;15:174-8.
6. Emanuel L, Berwick D, Conway J, et al. *What Exactly Is Patient Safety?* Chapter in book: Henriksen K, Battles JB, Keyes MA, Grady ML. *Advances in patient safety*. New directions and alternative approaches. Vol. 1. Assessment. AHRQ Publication No. 08-0034-1. Rockville, MD: Agency for Healthcare Research and Quality; 2008.
7. Vincent C. *The essentials of patient safety*. Wiley-Blackwell; 2011. Available at: [www.wiley.com/go/vincent/patientsafety/essentials](http://www.wiley.com/go/vincent/patientsafety/essentials).
8. Sharpe VA, Faden AI. *Medical Harm: Historical, Conceptual and Ethical Dimensions of Iatrogenic Illness*. Cambridge University Press, Cambridge; 1998.
9. Vincent C, Amalberti R. Safety in healthcare is a moving target. *BMJ Qual Saf*. 2015;24:539-40.
10. Vincent C, Amalberti R. *Safer Healthcare*. Springer International Publishing; 2016.
11. Vincent C. *Patient safety*. BMJ Books. Wiley-Blackwell; 2010.
12. Reason J. *Human error*. New York: Cambridge University Press; 1990.
13. Reason J. Human error: models and management. *BMJ*. 2000;18;320:768-770.
14. Vincent C, Taylor-Adams S, Stanhope N. Framework for analysing risk and safety in clinical medicine. *BMJ*. 1998;316:1154.
15. Institute for Healthcare Improvement. [http://www.ihl.org/communities/blogs/\\_layouts/15/ihl/community/blog/itemview.aspx?List=7d1126ec-8f63-4a3b-9926-c44ea3036813&ID=159](http://www.ihl.org/communities/blogs/_layouts/15/ihl/community/blog/itemview.aspx?List=7d1126ec-8f63-4a3b-9926-c44ea3036813&ID=159). Accessed March 14, 2017.
16. McGlynn EA, Asch SM, Adams J. et al. The quality of health care delivery to adults in the United States. *N Engl J Med*. 2003;348:2635-2645.
17. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. *Lancet*. 2003;362:1225-30.
18. Pierson DJ. Translating evidence into practice. *Respir Care*. 2009;54:1386-401.
19. Glasgow RE, Green LW, Klesges LM, et al. External validity: we need to do more. *Ann Behav Med*. 2006;31:105-8.

20. Reinertsen JL. Zen and the art of physician autonomy maintenance. *Ann Intern Med.* 2003;138:992-5.
21. Grol R, Berwick DM, Wensing M. On the trail of quality and safety in health care. *BMJ.* 2008;336:74-6.
22. Cabana MD, Rand CS, Powe NR, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA.* 1999;282:1458-1465.
23. Kahn JM. Disseminating clinical trial results in critical care. *Crit Care Med.* 2009;37(1 Suppl):S147-53.
24. Grol RP, Bosch MC, Hulscher ME, Eccles MP, Wensing M. Planning and studying improvement in patient care: the use of theoretical perspectives. *Milbank Q.* 2007;85:93-138.
25. Grol R, Wensing M, Eccles M, Davis D. *Improving Patient Care. The Implementation of Change in Health Care.* BMJ books. 2nd Revised edition; 2013.
26. Nilsen P. Making sense of implementation theories, models and frameworks. *Implement Sci.* 2015;10:53.
27. Eccles MP, Mittman BS. Welcome to implementation science. *Implement Sci.* 2006;1:1.
28. Pronovost PJ, Berenholtz S.M, Needham, D.M. Translating evidence into practice: a model for large scale knowledge translation. *BMJ.* 2008;337:a1714.
29. Pronovost PJ. Navigating adaptive challenges in quality improvement. *BMJ Qual Saf.* 2011;20:560-3.
30. Schein RM, Hazday N, Pena M, Ruben BH, Sprung CL. Clinical antecedents to in-hospital cardiopulmonary arrest. *Chest.* 1990;98:1388-92.
31. Andersen, LW, Won Young Kim WY, Chase M. The Prevalence and Significance of Abnormal Vital Signs Prior to In-Hospital Cardiac Arrest. *Resuscitation.* 2016;98:112-117.
32. Hodgetts TJ, Kenward G, Vlackonikolis I, et al. Incidence, location and reasons for avoidable in-hospital cardiac arrest in a district general hospital. *Resuscitation.* 2002;54:115-23.
33. Ludikhuizen J, Smorenburg SM, de Rooij SE, De Jonge E. Identification of deteriorating patients on general wards; measurement of vital parameters and potential effectiveness of the Modified Early Warning Score. *J Crit Care.* 2012;27:424.e7-13.
34. Kim WY, Shin YJ, Lee JM, et al. Modified Early Warning Score Changes Prior to Cardiac Arrest in General Wards. *PLoS One.* 2015;10:e0130523.
35. Hillman K, Parr M, Flabouris A, Bishop G, Stewart A. Redefining in-hospital resuscitation: the concept of the medical emergency team. *Resuscitation.* 2001;48:105-10.
36. Subbe CP, Kruger M, Rutherford P, Gemmel L. Validation of a modified Early Warning Score in medical admissions. *QJM.* 2001;94:521-6.
37. DeVita MA, Bellomo R, Hillman K, et al. Findings of the first consensus conference on medical emergency teams\*. *Crit Care Med.* 2006;34:2463-78.

38. Resar R, Griffin FA, Haraden C, Nolan TW. Using Care Bundles to Improve Health Care Quality. IHI Innovation Series white paper. Cambridge, Massachusetts: Institute for Healthcare Improvement, 2012. Available at: <http://www.ihl.org>.
39. How-to Guide: *Prevent Central Line-Associated Bloodstream Infections (CLABSI)*. Cambridge, MA: Institute for Healthcare Improvement, 2012. Available at: <http://www.ihl.org>.
40. How-to Guide: *Prevent Ventilator-Associated Pneumonia*. Cambridge, MA: Institute for Healthcare Improvement, 2012. Available at: <http://www.ihl.org>.
41. Berenholtz SM, Pronovost PJ, Lipsett PA, et al. Eliminating catheter-related bloodstream infections in the intensive care unit. *Crit Care Med*. 2004;32:2014-2020.